Problem: Find examples when a local max or min is not necessarily the global max or min.

Theorem: A continuous function \( f(x) \) defined on a closed, bounded interval \([a,b]\) will attain its (global) maximum and (global) minimum value.

The reason that we need a closed interval \([a,b]\) rather than an open interval \((a,b)\) is illustrated by the following examples. Below is an example of a continuous function on an open interval \((a,b) = (0,1)\) that attains a minimum value but does not attain a maximum value.

Person 1: Draw a continuous function on the open interval \((0,1)\) that attains a global maximum but does not have a minimum value.
Person 2: Draw a continuous function on the open interval $(0,1)$ that attains neither a maximum nor a minimum value.

![Graph showing a continuous function on the open interval (0,1) without a maximum or minimum value.]

Person 3: Read to the group: Now we will consider closed intervals $[a,b] = [0,1]$. In the following examples, the points $c$ and $d$ will always be critical points (i.e., $f'(c) = f'(d) = 0$) for the function. The point $c$ will be a local maximum and the point $d$ will be a local minimum.

In this example, $c$ is a global maximum and $d$ is a global minimum for the function on the closed interval $[0,1]$.

![Graph showing a continuous function on the closed interval [0,1] with a local maximum at $c$ and a local minimum at $d$.]
Person 3: Finish drawing the following graph so that the function has a global minimum at $x=0$ and a global maximum at $x=c$ yet the point $x=0$ is not a critical point.

Person 4: Finish drawing the following graph so that the function has a global minimum at $x=d$ and a global maximum at $x=1$ yet the point $x=1$ is not a critical point.

Person 1: Finish drawing the following graph so that the function has a global minimum at $x=0$ and a global maximum at $x=1$ yet the points $x=0$ and $x=1$ are not critical points.